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ABSTRACT

Twenty-four educable mentally retarded children (10 to 15 years old) were randomly assigned to one of three treatment conditions (repetition-control, verbal context, and imagery) to determine the effects of elaboration on paired associate (PA) learning. Data from performances on two lists supported the hypothesis that elaboration in the form of either images or verbal contexts would greatly facilitate PA recall. Analysis did not support a secondary hypothesis that the imagery elaboration group would recall significantly more nouns than the verbal context elaboration group. No statistically significant differences were found between the two types of elaboration. Results were discussed in terms of A.R. Jensen's theory of primary and secondary mental retardation. (Author/GW)

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MENTAL ELABORATION AND LEARNING IN RETARDED CHILDREN[1]

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Abstract

Jensen has recently extended his two level theory of intelligence to mental retardation. This theory implies that retarded children should be deficient in such conceptual abilities as elaboration of paired-associates. Although previous research investigating elaboration has tended to support this implication, the possibility exists that these studies may have utilized insufficient instructional sets and training procedures. In the present study 24 EMR children (CA 10-15) were randomly assigned to one of three treatment conditions: repetition-control, verbal context, and imagery. The major hypothesis, that instructions to elaborate in the form of either images or verbal contexts would greatly facilitate PA recall, was supported by the results from two lists. A secondary hypothesis, that the imagery elaboration group would recall significantly more nouns than the verbal context elaboration group, was not supported by the analysis. It is concluded that instructions to elaborate are an effective means of facilitating the recall of EMR children, and that their performances on both a standard PA task and a more complex 3-tuple task is greatly increased through such instructions.

MENTAL ELABORATION AND LEARNING IN RETARDED CHILDREN[1]

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Jensen (1969) proposed that the unitary concept of intelligence be subdivided into Level I and Level II abilities. More recently, Jensen (1970) has extended his theory to discuss primary and secondary familial mental retardation. In the latter paper he refers to "primary mental retardation" as a deficiency in associative abilities (Level I) while "secondary mental retardation" results from a deficiency in conceptual abilities (Level II). Jensen (1970) hypothesized that "normal" and "secondary retarded" subjects will perform equally well on a task dependent solely on associative abilities (e.g., digit span) but will differ on tasks which require Level II abilities (e.g., complex concept learning and problem solving.)

Several tasks are of particular interest with respect to Jensen's theory in that they may involve both levels of abilities. One such task is paired-associate (PA) learning. In his review of PA learning by the retarded, Jensen (1970, P. 85) concludes:

> These findings support the notion that PA learning is largely a Level I function which is facilitated by the amount of prior verbal experience largely associated with age, and may also involve Level II processes (mediational strategies, mnemonic elaboration, etc.) when the learning materials are of an abstract nature or are otherwise such as to evoke Level II processes in the learner.

Jensen's theory would thus seem to generate some clear statements about PA learning by the retarded. First, only the primary mentally retarded will show a deficit in rote PA learning, with secondary mental retardates performing at about the same level as normals.[2] Jensen (1970) concludes that this prediction generally fits the results reviewed by Goulet (1968) concerning normal-retardate comparisons.

A second implication of Jensen's theory is that normal children would exhibit recall superior to that of the retardate when the PA task is more abstract and allows for transformations (e.g., elaboration). Rohwer (1970) has begun to investigate some of the developmental implications of this prediction, but minimal research has as yet been conducted to test this hypothesis directly with the retarded. It has been proposed (Martin, 1967; Rohwer, 1968) that the superiority of normal children in PA learning is attributable to their propensity for engaging in self-activitated elaboration of the materials to be learned. One aspect of this contention is that the retardate may not be able to produce the appropriate elaboration. However, if this is the only deficiency, then supplying an appropriate context should reduce the PA learning differences between normal and secondarily retarded children. Several studies have demonstrated that supplying elaborative contexts in the form of sentences improves the PA learning of retardates (e.g., Jensen & Rohwer, 1963; Milgram, 1967; Turnure & Walsh, 1971), but no studies have demonstrated that supplying elaboration will reduce the learning differences between normal and retarded children.

An alternative to supplying children with elaboration is to train each child to construct his own elaborative contexts, which he can then use to learn the associations. This particular methodological strategy has been suggested by Rohwer (1968) as a means of facilitating learning. In addition, several verbal learning researchers have stressed the enrichment possibilities and educational implications of well developed instructional sets (Bower, 1970a; Davidson, 1970, 1970; Semmel, 1967). Although research emphasizing instructional sets to elaborate has been minimal with children, a few studies (Taylor, 1970; Taylor, Josberger, & Prentice, 1970) have found that normal children instructed to generate verbal contexts (or mental images) recall many more nouns than children not given instructions to elaborate.

Rather than studies comparing the effects of instructional sets on the recall of EMR and normal children, it would seem that instructional manipulations might better be used to develop treatments for retarded children (Baumeister, 1967). Previous research manipulating elaboration instructions with retardates has yielded somewhat inconsistent results. Whereas Milgram (1968) found verbal elaboration instructions to be beneficial with EMR children, MacMillan (1970) found no significant difference in recall between EMRs instructed to generate sentences and those not given such instructions. Macmillan concluded that EMR children are poor at generating effective mediators even when given instructions to do so, but he did acknowledge that the training given the EMR group in his study may have been inadequate.

The major hypothesis tested in the present study was that EMR children given instructions to elaborate noun pairs would recall significantly more than EMRs instructed to repeat the noun pairs without elaboration. The present study also compared the relative effectiveness of two types of elaboration instructions--imagery and verbal context (sentences). It has been suggested that imagery should result in more PA learning than verbal contexts because imagery seems to supply multiple memory codes (Paivio, 1969) and because imagery may result in spatially organized relations for each pair (Bower, 1970b; Taylor, 1970). The relative superiority of imagery over verbal elaboration has been given some empirical support with adults (Bower, 1970b; Paivio & Foth, 1970), but not with children (Montague, 1970; Taylor, 1970). No previous studies have compared imagery and verbal elaboration with retarded children.

Method

The subjects were 24 children from three classes for educable mentally retarded children in Bloomington, Indiana. The children ranged in age from 10-15 years, with mean CA=12.6. All children in the sample had Lorge-Thorndike IQ scores lower than 75, with the mean IQ for the sample being 70.2. The three schools involved were located in lower to lower-middle class areas, and it appeared that majority of the children tested were cultural-familial retardates. The only subject showing evidence of organic impairment (later verified in school records) was dropped from the study, as described below.

The subjects were randomly assigned to one of three experimental groups, which were defined by the instructional treatments. The mean IQ's for the three groups were 70.1 for the eight subjects given imagery instructions, 70.6 for the verbal elaboration group, and 69.9 for the eight control subjects given repetition instructions.

Each subject was tested by one of two experimenters, with each experimenter testing four subjects in each of the three conditions. Due to the nature of the procedures two a priori conditions were specified under which subjects would be dropped from the study. First, the use of verbal recall procedures required that the subject be able to communicate his responses clearly and within a limited period of time. One subject from the imagery condition was dropped because of his extremely slow verbal communication (this subject was referred to above). Due to the importance of adherence to the instructions, subjects were eliminated if during post-experimental inquiry they admitted not using or not attempting to use the strategy specified in the instructions. The data from one subject in the verbal condition and one subject in the imagery condition were lost due to the self-reported failure of both subjects to follow the specified instructions (both reported using a repetition strategy).

Materials. The nouns used were drawn from previous studies involving elaboration (Rohwer, 1967; Taylor, 1970; Taylor et al., 1970). The 64 nouns for this study were selected on the basis of the following criteria: presence in the reading and speaking

vocabularies of retarded children, ease with which sentences could be generated using each noun, and high picturability or concreteness of the referent of each noun. All words met the stated criteria in pilot tests conducted with younger retarded children (CA = 8 - 11).

Subsequently the 64 concrete nouns were distributed into three lists containing 16, 24, and 24 nouns respectively. The nouns in Lists 1 and 2 were paired such that no direct associations between pairs was evident. List 3 was divided into eight sets of three nouns, with each "3-tuple" composed of one stimulus and two response nouns. The 3-tuple list was constructed so as to avoid direct association between any two nouns of a set. The lists are presented in Table 1.

Insert Table 1 about here

Sixteen additional nouns drawn from the same source were used as examples throughout the training session. The only additional materials used in the present study were two line drawings in black ink on white 5 x 8 cards. These drawings were used as instructional aids in the training of imagery subjects, during the first two training pairs. No instructional materials accompaned the training of the other groups.

Procedure. Each child was tested individually in a small, relatively quiet room. He was seated across a table from the experimenter so that eye contact could be maintained. The children were randomly assigned to one of the three instructional treatment conditions, and each child was tested for one trial on each of the

three paired-associate lists. Since the experimental treatments were not administered until after the first list, List 1 served as a warm-up list for the subjects as well as a baseline measure of their paired-associate learning. Before the presentation of the warm-up list each subject was informed about the general procedure. He was told that he would be read pairs of words, that he should repeat each pair aloud immediately after the experimenter read it, and that he should remember the words so that when presented with one of the words (the stimulus word) he could provide the other word. The presentation of the warm-up list was preceded by the presentation and testing of three practice pairs in order to insure that the subject understood the PA task. The eight pair warm-up list was then presented at the rate of 10 seconds/pair. After all eight pairs were presented recall was tested at a 10 second/pair rate. Immediately after this testing, and prior to the presentation of List 2, the instructional treatment was administered to the subject.

The instructional treatment prior to presentation of List 2 consisted of asking the subject to use a special way to remember the words. This special way defined the three levels of the independent variable, and subjects in each experimental group received a different instructional set and the appropriate training procedures. For instance, subjects in the imagery condition were instructed to make up a picture about the two words doing something together. Subjects in the verbal elaboration condition were instructed to

make up a sentence about the two words, and the repetition-control subjects were to repeat the noun pairs over and over. Although no instructions were given about repeating words aloud, saying sentences aloud, or describing images, most of the subjects were observed to overtly verbalize.

The training for all three conditions followed the same general pattern: the individual presentation of three practice pairs with a lesser amount of instructional aid accompanying each succeeding pair. For example, in imagery training the first practice pair was accompanied by a line drawing depicting an interaction of the referents of the two words (the example used was a picture of a boy kicking a cup). The second practice pair was accompanied by line drawings of isolated pictorial representations of the two words with instructions to imagine an interacting picture, and no instructional aids accompanied the third practice pair. In the verbal condition the first practice pair was accompanied by an experimenter generated sentence (the example used was - The boy kicks the cup). The procedures for the second pair consisted of having the subject generate a sentence using the two nouns, and no examples accompanied the third pair. For the repetition-control subjects, the experimenter provided verbal instructional aids by repeating the noun pairs over and over in the appropriate manner. After training, each subject was tested on the three practice pairs and asked to describe how he tried to learn the pairs.

The subject was then informed as to the procedure to be followed

in the remaining portion of the experimental session and given an opportunity to ask questions, which the experimenter answered by repeating relevant portions of the instructional set. After questioning, List 2 was presented and recall tested. Immediately after the testing of List 2, the 3-tuple list was introduced, presented, and tested in a similar manner to the second list. The instructional phase prior to presentation and testing of List 3 was essentially the same except that 3-tuples were employed and only two practice 3-tuples were used. The main point of these instructions was that the child was to do the same thing with three words as he did with two words in the previous list.

Rate of presentation and testing were originally set at 5 seconds/word, which amounted to 10 seconds/pair on Lists 1 and 2 and 15 seconds/3 tuple on List 3. However, pilot testing revealed that several subjects had trouble completing the task within these time constraints and often asked for words to be repeated, particularly on List 3. Therefore, time was not controlled beyond an attempt to approximate the time intervals specified above. For example, if the subject was beginning to respond when the designated time period had elapsed, additional time was allowed without penalty in scoring. The order within lists for presentation and testing was randomly determined, with three random orders used for each list. All lists were always tested in a different random order from which they were presented in.

Results

The data were analyzed by a 3 x 2 (Instructional Set x Experimenters)

analysis of variance. A separate analysis was computed for each of the three lists with the number of nouns correctly recalled as the dependent measure. In each analysis there was a non-significant main effect for experimenters ($F<1$) and a non-significant Instructional Set x Experimenter interaction.

The data were then pooled across experimenters, thereby providing for a separate one-way analysis of variance for each of the three lists. Table 2 shows the mean number of correct responses for each condition within each list. As expected, non-significant differences were obtained on List 1 ($F<1$) where all groups were treated identically.

Insert Table 2 about here

The one-way analysis for List 2 revealed a significant difference between the groups [F (2,21) = 17.33, p <.001] which accounted for slightly over half the total variance in recall (est. ω^2 = .57). Two orthogonal planned comparisons were used to test the hypotheses specified (Edwards, 1968, p. 150). The first comparison revealed that imagery and verbal instructions facilitated recall when compared to the repetition-control group (p < .01). However, the s cond planned comparison revealed that the mean of the imagery g oup did not differ significantly from the mean of the verbal group (p > .05).

The findings for List 3 were essentially the same as those for List 2. The one-way analysis revealed a significant main effect for instructional set [F 2,21) = 28.22, p <.001], which accounted for 69% of the total variance in recall for List 3. The same orthogonal planned comparisons were computed for the 3-tuple list

with exactly the same differences and probabilities obtained as for List 2.

The means in Table 2 were converted into percentages (mean recall/total possible) in order to better compare the differences across lists. The percentages are presented in Table 3. At least two observations are of interest in Table 3. First, the percentage of nouns recalled for the repetition group fell markedly from List 2 to List 3; and second, the percent of nouns recalled by the elaboration groups relative to the repetition group increased from about three times as many on List 2 toabout seven times as many nouns recalled on List 3. It seems from these percentages that the 3-tuple list was more difficult only for the repetition group. However, since lists were confounded with order of presentation this increased difficulty could be due to other factors including a decline in attention from List 2 to List 3 by the repetition subjects.

Insert Table 3 about here

The study was an effort toward clarifying the educational issue of the effectiveness of elaboration treatments for facilitating recall in retarded children. The effectiveness of the elaboration treatments in the present study can be compared with the performance of the same children on List 1 before they were given elaboration training or with the performance of children from the same population given rote repetition instructions.

On the average, the 16 subjects from the elaboration conditions

recalled about 19% of the words correctly from List 1. However, on the longer PA task (List 2) where they were given elaboration instructions these same subjects recalled about 75% of the words correctly (See Table 3). It might be possible to interpret this gain as a practice effect, but if this was the case the repetition subjects should have also shown a large gain. Table 3 reveals that the percent recalled by the repetition group was about equal for Lists 1 and 2. Thus, it seems that type of treatment (elaboration in the form of imagery or verbal context generation), and not practice, facilitated recall. Further, these treatment effects seem to be quite robust with both elaboration groups recalling more than three times as many nouns as the repetition group on List 2 and about six times as many nouns on List 3.

Although the facilitating effects of elaboration instructions on the recall of educable mentally retarded children was clearly demonstrated in this study, no statistically significant differences were obtained between the two types of elaboration. However, the recall scores on Lists 2 and 3 were in the predicted direction, with imagery subjects recalling slightly more nouns than subjects given verbal elaboration instructions. Taylor (1970) reported several studies using normal children where the same non-significant differences were found between imagery and verbal elaboration, but recently Taylor and Whitely (1971) found imagery to be significantly superior to verbal elaboration. The Taylor and Whitely study differed from the present study in that, a) elaborate training procedures were used and b) the task permitted spatial organization. Until these

or other procedural improvements are developed for retarded children, it seems neither theoretically or educationally relevant to compare recall with imagery and verbal elaboration instructions.

Certain other procedural aspects of this study seem to merit discussion. For instance, it was noted that the EMR children given elaboration training tended to overtly verbalize their elaborations as they constructed them. It is suggested that this overt verbalization may have further facilitated the recall of the subjects given elaboration instructions. A second procedural aspect concerns the subjects utilized. Other researchers have noted the difficulties in using supplied elaboration (Milgram, 1968; Rohwer & Lynch, 1968; and Zigler, 1969) or aboration instructions with institutionalized retardates (cf, Milgram, 1968). Whether elaboration is truly less effective with th se subjects, or whether the current elaboration training procedures are inadequate for this type of subject, can only be answered by further research.

The major finding of the study was that EMR children (secondary mental retardates) are quite capable of generating elaborative contests when given an instructional set which adequately tr. ins them in how to construct the sentences or images. From Jensen s (1970) definition of Level II abilities, it would seem that generating an elaborative context to learn PAs is a task dependent on Level II (i.e., conceptual, transformational, etc.) abilities. The results of the present study do not answer the question of whether EMR children are deficient in Level II abilities, rather these results demonstrate that the associative learning of these children can be facilitated

by training in Level II strategies. Thus Jensen's (1970) suggestion that secondary retardates' education should be focused upon tasks which utilize only Level I abilities seems at best premature. This is further supported by the fact that the repetition-control group performed unsatisfactorily on the PA list and even more poorly on a more complex 3-tuple task. Alternatives to this rote strategy must be developed and supplied to those learners who presently rely on such rote learning strategies.

Finally, it seems that the potential for increasing learning rate and memory organization is great with elaboration instructions. The development of instructional training procedures along with the increased emphasis on the organization of the materials to be learned (Bilsky & Evans, 1970; Turnure & Walsh, 1971), may increase the liklihood of facilitating the performance of EMRs on educational tasks such as vocabulary building, reading comprehension, and concept learning.

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[2]It is unclear from Jensen's paper (1970) exactly who are the secondary mentally retarded children. It seems that educable mentally retarded (EMR) children who are neither institutionalized nor organically impaired make up a majority of those children Jensen refers to as secondary mentally retarded. However, Jensen (1970) suggests that even some of these children may suffer from primary retardation. In the present paper these EMR children will be considered to be secondary mental retardates.

Table 1

Lists used in Study 1

LIST 1	LIST 2	LIST 3 (3-Tuples)
Cat-Log	Man-Fork	Broom -- Snake Flashlight
Pencil-Potato	Devil-Truck	Tire -- Mop Button
Girl-Umbrella	Frog-Clock	Spider -- Clown Tent
Blanket-Table	Bird-Pie	Bread -- Scissors Lock
Car-Horse	Needle-Sock	Piano -- Fan Zipper
Elephant-Strawberry	Bat-Lion	Mailbox -- Turtle Donut
Rope-Dress	Knife-Box	Bullet -- Toothbrush Letter
Hammer-Bell	Shoe-Cake	Dog -- Radio Skate
	Horse-Hat	
	Baby-Bicycle	
	Fire-Chair	
	Doll-Book	

Table 2

Mean Number of Nouns Correctly Recalled as a Function of Instructional Set on 3 Lists

	INSTRUCTIONAL SETS			
Lists	Repetition	Verbal	Imagery	Total
1-(baseline PA)	1.75	1.38	1.63	1.58
2-(12 PA)	2.88	8.50	9.25	6.88
3-(8 3-tuple)	1.50	9.88	10.62	7.33
Total (2+3)	4.38	18.38	19.87	

Table 3

Percent of Nouns Recalled Correctly on Three Lists as a Function of Instructional Set

	INSTRUCTIONAL SET			
Lists	R-C	Verbal	Imagery	Total
1-(PA baseline	21.8	17.2	20.3	19.8
2-(12 PA)	23.9	70.8	77.0	57.2
3-(8 3-tuple)	9.3	61.7	66.4	45.8
Total (2+3)	16.6	66.2	71.7	